Elementary Education Online, 2019; 18(2): pp. 461-471
İlköğretim Online, 2019; 18(2): s.461-471. [Online]: http://ilkogretim-online.org.tr
doi: 10.17051/ilkonline.2019.561888

Criteria-based Assessment of Spatial Representations in Primary School Students

İlkokul Öğrencilerinde Mekânsal Temsillerin Kriterlere Dayalı Değerlendirilmesi

Guldana Totikova, *South Kazakhstan State University named after M. Auezov, g.totikova@rambler.ru*, ORCID: 0000-0002-8487-2767
Nurlan Aldabergenov, *M. Saparbayev South Kazakhstan Humanitarian Institute, anurlan-62@list.ru*
Jaina Salmirza, *M. Saparbayev South Kazakhstan Humanitarian Institute, jayina@mail.ru*
Gaziza Nazarova, *M. Saparbayev South Kazakhstan Humanitarian Institute, nazarova.gaziza@mail.ru*
Arzu Gurbanova, *M. Saparbayev South Kazakhstan Humanitarian Institute, arzu_gur@mail.ru*
Nurlybay Madiyarov, *South Kazakhstan State University named after M. Auezov, madnur69@mail.ru*
Aidarbek Yessaliyev, *South Kazakhstan State University named after M. Auezov, aidar.esali@mail.ru*

Abstract. The formation of spatial representations in schoolchildren is one of the most important tasks of the teaching methods of mathematics in the primary school. The images of phenomena, actions, objects that reflect spatial relationships of size, shape, location, and movement of objects are mentally created with spatial representation. The problem of performance assessment is one of the most urgent problems in pedagogical practice. In addition, subjectivity of the school marks, which is already observed at the initial stage of teaching, is the main problem in the assessment. The solution to this problem is contributed by an introduction into the practice of criteria-based assessment, i.e the assessment process based on the comparison of students' learning achievements with clearly defined, collectively developed criteria known to all participants of the educational process that are consistent with goals and content of education, promoting the development of students' ability to study.

Keywords: Criteria-based assessment, spatial representation, mathematics, primary school, educational achievements

Öz. Öğrencilerde uzamsal algı oluşturmak, ilkokul matematik öğretiminin en önemli amaçlarından biridir. Görsel-mekansal algı; nesnelerin boyut ve şekillerini algılama, uzaydaki konumlarını ayırt etme, farklı uzaysal ilişkileri anlamayı kapsar. Öğrenci performansı değerlendirmesi, pedagoji alanındaki en yaygın problemlerden biridir. Ayrıca, öğretimin ilk aşamasında bile izlenebilen ders notlarının öznelliği, değerlendirmenin ana problemidir. Bu problemi çözmek için, ölçüt dayanaklı değerlendirme uygulanır. Bu süreç, öğrencilerin derslerdeki başarıların; açıkca belirlenmiş ve topluca kararlaştırılmış, önceden tüm eğitim-öğretim üyelerine bildirilen, eğitim sürecinin amaç ve içeriğine uygun ve öğrencilerin anlama ve kavrama becerilerini geliştiren kriterlerle karşılaştırılmasına dayanır.

Anahtar Sözcükler: Ölçüt dayanaklı değerlendirme, mekansal gösterim, matematik, ilkokul, eğitim başarıları

Received: 01.12.2018 Accepted: 21.01.2019 Published: 15.04.2019

INTRODUCTION

The mental processes of a child, such as perception, attention, memory, imagination contribute to the formation of his/her spatial intelligence. As many psychologists and educators suppose, one of the main criteria for the mathematical development of a personality is the level of development of spatial representation, which is characterized by the ability to operate with spatial images. The basis for the development of spatial intelligence, as mentioned, are spatial representations that reflect relationships and properties of real objects, that is, properties of the three-dimensional visible or perceptive space (Pyshkalo, 1973).

Fundamental studies of Ananiev (1977), Leontiyev (1972), Usova, Zaporozhets (1965), Zinchenko (2002), Vekker (1998) and others present that the formation of the sensory image at the level of perception is carried out in the process of the active transforming activity of the subject.

Specially organized perceptual activity, based on the certain methods of object investigation, application of the conceptual apparatus (various criteria of analysis) provides a multidimensional and multilevel perception (Kosov (1997), Shekhter (1981), Yakimanskaya (1990), etc.).

In the process of assessment of educational achievements of students, mastering spatial representations and having the spatial imagination are one of the main criteria for the students' knowledge in the field of mathematics. Criteria-based assessment is achieved by clearly defined, collectively developed criteria, known in advance to all participants of the educational process, corresponding to the formation of the educational-cognitive competence of primary school students. The objectivity of the marks at criteria-based assessment is confirmed with descriptors, which creation involves students' participation, discussion and comparing of marks. This assessment system allows students to become active not only in the learning process, but also in assessing the results of their learning process.

The purpose of the research is to characterize modern methods and forms of technology of criteria-based assessment, which contributes to the formation of educational and cognitive competence at using didactic means of spatial representations development on the mathematics lessons by students of primary school.

METHOD

Methodological basis for this study were: the theoretical analysis of psychological and educational literature; study of the formation of the spatial representation of the primary school students on the mathematics lessons; analysis of methods of knowledge assessment; observation; organization and conducting of the ascertaining, forming and control stages of the experiment; processing of results. The complex of complementary research methods was used to achieve the purpose, among them are theoretical methods: psychological, educational methods, analysis and study of scientific and methodological literature on research problems. Analysis of methodological documentation, general theoretical methods of analysis, synthesis, theoretical modelling, the research and generalization of pedagogical experience on the research problem, conceptualization of educational practice were also conducted.

For this study, we examined related materials that cover the subject of education system of Kazakhstan and effective training methods aimed at comprehensive personal development of students (National report on the results of an international study of PISA-2009 in Kazakhstan, 2010; On the peculiarities of teaching the fundamentals of sciences in general education organizations (including inclusive education) in the Republic of Kazakhstan in 2014-2015 academic year, 2014; On the implementation of the National Action Plan for the development of functional literacy of schoolchildren for 2012-2016, 2012; The system of criteria-based assessment of students' learning achievements, 2013; Ponomarenko, Kenzhebekova et al., 2016; Ponomarenko, Zholdasbekova et al., 2016; Ponomarenko, Yessaliyev et al., 2016; Madiyarov, Yessaliyev, & Totikova, 2017).

RESULTS

One of the global modern trends in education is the humanization of school education, the orientation of the learning process towards the individual interests of students. The task of creating optimal conditions for the identification and development of students' abilities, meeting their interests and spiritual needs, ensuring self-determination and searching for 'his/her place' in life goes to the forefront of school education. One of the aspects of personality development is the development of mental activity, in particular, spatial intelligence.

In the process of life and activity, people develop knowledge about environment. The perception formation occurs in the study of mathematics at the secondary school and the spatial awareness is developed. Spatial representations and spatial awareness of a child are prerequisites for the formation of the spatial intelligence and they are provided with various mental processes, such as perception, attention, memory, imagination, including speech in the first place.

Problems of spatial representations development were studied by many psychologists and methodologists. Among psychologists are Ananiev (1977), Gurova (1961), Galkina (1961), Pavlov (1951-1954), Rubenshtein (1998), Sechenov (2001), Beloshistaya (1999) and other researchers of the principle of space perception. Methodological issues related to the formation and development of spatial representations in the process of teaching geometry elements in the primary school were considered in the works of Arginskaya (2009), Bantova, Pyshkalo (1991), Istomina (2001), Moro (2014), Peterson (2012), Kochetkova (1996) and others. The studies of psychologists show that the spatial representations are developed from sensorimotor space and then it becomes projective and metric by the age of 9-11.

The features of spatial representation and spatial awareness are formed as a special integrated sensory-perceptual ability and they are based on mastering perception methods, reproduction (modelling) and transformation of spatial relations. In the early stages of development, its formation is associated with the emerging in a child awareness of the own body, movement development, subject-practical activity, visuomotor coordination. The understanding about the relationship of external objects is formed in relation to the own body (about objects' placement using the notions 'top-bottom', 'from which side', distance of object's location), to the peculiarities of spatial relationships between two or more objects located in the environment at the same time.

The development of spatial representations of this block in the preschool childhood is subject to one of the main laws of development - the law of the main axis: at first the vertical representations are formed, then the horizontal representations: direction frontwards, then - on the right and left sides. The concept 'backwards' is formed later. The result of the child's development at this stage is a holistic view of the world in the perception of the spatial relationships between objects and the own body (structural-topological representations).

The next important step is to master the sign culture (gestural, verbal, graphic) that leads to the formation of generalized representations, applicable for modelling space, its transformation in the mental plan. The logical-grammatical constructions are the top of acquisition of spatial representations. They include all the prepositional structure of our language, comparative categories, etc. This level is the most complex; it is formed later and developed as a speech activity and as one of the main components of the child's perception and thinking.

One of the main directions of the solution of this problem should be children's formation of orientation on the plane of sheet, because this is related to the essence and content of many school skills and activities (writing, reading, manual work, orientation in the page of the textbook, notebooks, in space of the desk etc).

The content of spatial intelligence is the handling with spatial images in a visible or imaginary space (in a plane). In this way, spatial intelligence differs from other forms of thinking, where the isolation of spatial characteristics is not a central point.

According to Yakimanskaya (1990; 1989), spatial intelligence is structurally represented in two types of activity: the creation of a spatial image and the transformation of an already

created image in accordance with the set task. When a person creates any image, including spatial, visual basis undergoes the mental transformation, on the basis of which it arises. Real object and its graphical (picture, drawing, graph, etc) or symbolic (mathematical or other symbols) model can act as a real basis. In any case, in creating images, a recoding takes place, which preserves not so much the appearance, as the outline of an object, its structure and the location.

The formation of spatial representations should be carried out taking into account a complex structure of orientation in space, its genesis directly connected with development of thinking, speech and activity of a child. In this regard, special attention should be paid to enriching the sensual, motional experience of children, the experience of practical activities, the formation of understandings about the body structure, own position among surrounding objects, as well as the variability and relativity of spatial relations. It is important to teach children the actions of substitution, modelling, coding and decoding of space on the basis of the unity of the image-motional, image-graphic and verbal sign, in connection with which children learn to perceive and recreate real spatial relationships in gestures, in visual models and in speech. Special attention should be paid to the implementation of a constant transition from the plan of real, three-dimensional reality to the plane, to the conditions of the coded space, and on the contrary; the formation of the ability to read and understand the language of graphic images.

The process of space perception and spatial properties of objects is realized not only on the basis of the interaction of the existing excitement arising in the cortical centres of the visual and motional sensory receptor, but also includes traces of past excitements. Therefore, the spatial presentation of a subject is also of great influence on the completeness of the process of space perception and spatial properties of objects. Further psychological studies of this problem have made it possible to establish that during the ontogeny of spatial representations a number of regular stages of its development take place: first it is interlaced into other types of representation, and in its most developed and independent forms it appears in the form of spatial images.

In the process of activity, a person allocates spatial relationships in perceived space, reflects them in representations or concepts, but it is often necessary not only to fix them and regulate person's activities accordingly, but also to predict new relationships that were not previously perceived. Basing on the knowledge of acquaintance of given spatial relationships using a complex system of mental actions, a person creates new spatial images and expresses them in verbal or graphic form (in the form of diagrams, pictures, drawings, drafts).

Yakimanskaya (1990) considers the image, as "the basis of the operational unit of spatial representation, since the spatial characteristics of the object are mainly represented in it: shape, size, interdependence of the constituent elements, their location in the plane, in space according to any given reference point."

Thus, spatial representation is a complex mental education that has an independent line of development at all stages of ontogeny. Originating in the depths of practical activity (at special orientation, at performance of measuring works), it gradually turned into an independent kind of theoretical activity in the process of the historical development of a man.

However, spatial representations are characterized not only with the creation of corresponding images, but also with their handling, 'recoding', which occurs on the basis of the representation.

Comprehensive analysis of spatial representations as a special kind of mental activity that provides creation of spatial images and their handling in the process of solving various practical and theoretical problems is presented in the works of Yakimanskaya (1990; 1989), Kaplunovich (1996), Stoletnev (1979), Andryushina (2000) and other researchers. These scientists have identified its structural components, features of development at different stages of ontogeny.

Andryushina (2000) proposed the following schematic model-structure of the spatial representation:

Where the image captures the sides and properties of objects that are necessary for human activity, action is a necessary condition for the formation of practical generalizations, situational values, comprehension of learning situations and transfer of new forms of behaviour

and actions to a new situation. The concept is considered as a product of mental actions, which is formed, developed and expressed by a person with the help of a word.

Yakimanskaya (1990), Kaplunovich (1996), Stoletnev (1979) point out that "the structure of the spatial representation is the set of operations performed in the representation of images of spatial figures, homomorphic in the group of affine image with set relations."

The spatial images that the representation operates on must be dynamic, mobile and operational. These qualities derive from the conditions of their creation and operation with them. Mobility, dynamicity of images is due to the fact that in the process of solving the problems, a constant transition from volume (three-dimensional) images to planar (two-dimensional) and backwards, from the perception of real objects to their graphic images is required.

Initial visualization is only the primary basis for creating an image. In the process of solving the problem, the image is repeatedly transformed. Its transformation is closely connected not only with the preservation of the image in memory, but also with using conceptual apparatus that determines the ways of image transformation in the logic of the problem. The creation of images provides the accumulation of representations, which in relation to the image, are the initial base, necessary condition for its implementation. In psychology, representations mean images of events, objects or phenomena that arise on the basis of their remembering or active imagination.

Kabanova-Meller (1968) points out that: "Spatial representations are images that reflect the spatial properties and relations of objects, which are divided into images of memory and imagination. They differ in the ways they are created. The former is the result of the activity of spatial memory, the latter are created with the processes of imagination, which in turn are divided into the processes of the recreating and creative imagination. The process of recreating is characterized by the creation of new images on the basis of predetermined visual material."

Modern research-scientists (Andryushina (2000), Kaplunovich (1996)) hold the opinion that the content of the term 'spatial representations' has a synthetic character, since it includes representations about the shape of the object, its position in the space, size, distance, direction and other spatial relationships and connections.

Thus, Kaplunovich (1996) gives the following definition: "Spatial representation is the reconstruction or actualization of images of spatial bodies (figures), their properties and relationships in memory or in perception of real objects, their graphic images." This definition is a logical continuation of the research line of Yakimanskaya (1989), who says that: "In the image, as distinct from the concept, not individual, isolated attributes and properties of objects are reproduced, but their spatial dimension, characteristic for the real object possessing these properties, is reproduced." This stands out particularly clearly in the description of objects. The transition to the image formation on the representation is characterized both by the complication of the forms of perceptual activity, and by the change in the conditions of its behaviour. The productivity of the process acquires new features here. This is due to the fact that the creation of an image in the representation is carried out mainly when there is lack of the object and is provided with the transforming activity aimed at the mental modification of the object of perception (or data from the past sense experience). The fulfilment of these mental transformations is achieved by the special activity of the representation, consisting in the deliberate and arbitrary reproduction of an image and its mental handling in the solution of the set task. The activity of the representation is considered as a psychological mechanism of spatial representation, which provides recoding of images, usage of different reference systems, handling in the process of solving the problems by various properties and attributes: shape, size, spatial relations of objects. All this activity is carried out mainly in a figurative form, and also as a basis for a spatial representation that distinguishes it from imaginative thinking and proceeds in various forms and at different levels.

The activity of the representation appears in the process of creating the image through cogitative transformation of its visual basis more independently. It has a clear structure, expressed in a certain system of actions, the sequence of their implementation. Its result is the creation of the representation.

This activity is characterized by:

1. special conditions of image creation (deviation from visual basis);
2. content of the activity of the representation (transformation of existing images);
3. the level of complexity of its implementation (transformations are carried out in the mind on representation, represent repeated transformations, the whole system). It is a necessary prerequisite for solving constructive and technical problems.

The abovementioned statements of Yakimanskaya define the activity of representation as "The basis of interrelated processes - creation of spatial images and their handling, but the structure of this activity, the conditions for its implementation are different in both cases." In the first case, this activity is aimed at creating a spatial image, in the other it is aimed at its processing (mental modification, transformation) in accordance with the set task (here, cases of simple handling with an image that do not lead to its change are not considered).

At handling with image mentally, the image already created is mentally altered, often in the setting of complete deviation from the original form. The transformation of spatial images can be carried out simultaneously in several directions or in a certain one, but again there is a deviation from the original image (images) and without preserving either the contours, or the structure, or the relationship of the parts.

Before starting school, children accumulate a large number of representations about shape, size and relative position of various objects in the plane and in the environment. But since the experience of children and accumulation of terminology are of a casual and episodic nature, as a rule, there is no conscious understanding of the relationship between objects expressed with words 'identical', 'different', 'larger', 'smaller', 'on the right', 'on the left', 'between' and others. The space perception, realized as a result of the subjective experience of a child on the empirical basis, is complicated for the junior schoolchildren because the spatial features of objects merge with the perceived content; they are not isolated as special separate objects of perception.

The word, as guiding, allows them to select from cumulative evidence of the object as single: either shape, or size, or position relatively to other objects. However, a child finds it difficult to characterize one or another feature. At differentiating spatial features, there are some difficulties for the children of primary school age, also with using the concept of 'size', which is formed by them, as a rule, mainly in the study of the quantities: length, area, volume. In the younger school age, especially at the primary stage of education, the main indicator of the formation of spatial representations is the recognition and differentiation of spatial features on the basis of perceptual activity (perception of the object). The operational unit of spatial perception of an object is an image that is characterized not only and not so much by spatial features (shape and size), but in a greater degree by spatial relationships that determine the direction (forward - back, up - down), distance (far - near), location (high - low, short - long) and so forth.

One of the psychological characteristics of children of primary school age is the prevalence of visual-figurative thinking and the image is used at the first stages of teaching mathematics as the basic operational unit of spatial representations of younger schoolchildren. However, great opportunities for the further development of this kind of thinking, as well as for visual-efficient thinking are delivered by working with geometric material on the mathematics lessons, when a child correlates as one-to-one the image, representing the spatial features of an object, and the word. In this case, the formation of spatial representations gives the child an opportunity to operate on them not only at the level of recognition and differentiation of the object according to spatial characteristics, but in the first place at the level of the mental reproduction of the object image and changing its position in space to place and orient the object in any reference system, that is to understand its position among the totality of other objects.

Zankov (1999) considers following: "Precisely this approach to the study of geometric material makes it effective for the development of children". The formation of spatial representations in younger schoolchildren promotes the development of perception, memory, attention, development of mathematical concepts by younger schoolchildren on the basis of

meaningful generalization, which means that the child develops in the learning material from the particular to the general, from the concrete to the abstract. The transition from visual-figurative to visual-efficient thinking requires a complex analytical and synthetic work, highlighting details, comparing them with each other, which is inconceivable without child's developed spatial representations and spatial imagination. In this process, great importance is attached to speech, which helps to name the features and to compare signs. Only on the basis of the development of visual-effective and visual-figurative thinking, formal-logical thinking begins its formation at this age, which together with the visual-figurative and visual-effective thinking is the foundation of mental development of the younger student. At the same time, with the help of each of them, certain qualities of the mind will be formed by the child.

DISCUSSION

The formation of spatial representations of students on the mathematics lessons can be assessed. During compulsory schooling phase, teachers regularly assess students' achievements in class. Bruner (1962) considers the assessment to be a constituent part of learning activities structure. In practice, teachers' assessments are based on comparing the standard of knowledge of each student with other student's standard of knowledge of the same class. As a rule, teachers' assessment based on the comparison with the average, high and low levels of knowledge of students in class; while there is no guarantee that two students, who have received the same assessment by different teachers in different schools, show the same standard of knowledge. The assessments given to students do not provide a clear picture of their knowledge and skills (or knowledge not yet received) within the individual aspects of the subject. Thus, assessment cannot be used to monitor students' achievements over a period of time, or to identify gaps in knowledge and skills. The assessment results cannot be reasonably used to compare student's achievements in class with student's achievement from other schools, or with a national expected level of achievement of students of a certain grade. The assessment results cannot also be reasonably used to determine whether a student has mastered all the knowledge and skills necessary for the next grade.

Checking notebooks of a number of students gave reason to assume that teachers grade low scores on a 5-grade scale reluctantly. Is the reason connected with the fear of students' demotivation or with the fact that this may have a negative impact on their teaching activities? But as it would seem, the teachers didn't grade 1 ('very bad") or 2 ("unsatisfactory") within the scale. This led to the fact that a significant number of students, apparently including students with an average and low achievement in each class, received together a score 3 ("satisfactory"). This distribution of student's knowledge assessments is not a normal distribution of abilities, not helping to identify students with the most difficulties in learning. At the same time, if at-risk students are not informed that their work does not comply with the standard of instruction, then this category of students will not have any reason to strive to improve the level of academic achievement. The shortcomings described above can be overcome by using appropriate methods of "criteria-based assessment" (Mozhayeva, Shilibekova & Ziedenova, 2016; Criterial system for assessing students' academic achievements in Nazarbayev Intellectual schools, 2013) with the appropriate teachers' training for effective usage of these methods. The assessment methods based on criteria have already been implemented in Kazakhstan. Another way to convey criteria and standards is by constructing a list of items that a teacher will use in grading the paper and that the student or peers can self-check beforehand (Walvoord & Anderson, 1998). In assessing the quality of a student's work or performance, the teacher must possess a concept of quality appropriate to the task, and be able to judge the student's work in relation to that concept (Sadler, 1989).

It is important to distinguish between assessment for learning achievements and other forms of assessment conducted by the teacher. Summarizing the main characteristics of this kind of assessment (often also called nominal), it should be emphasized that assessment for learning is built in the teaching process and learning, and their essential part involves discussion and

general recognition of learning objectives by teachers and students, aims to help students to understand the learning standards they have to achieve, involves students in self-assessment or partner assessment, provides feedback that helps students determine which next steps in the learning they have to take, strengthens belief that each student can bring about an improvement, involves both teachers and students in the process of review and reflection of assessment data.

The objectivity of assessments in the criteria-based assessment (Table 1) is confirmed by descriptors, which creation involves students' participation, discussion and comparing marks. The usage of descriptors as qualitative assessment criteria that describe the level of the learner's developed competencies and allow determining the degree of their manifestation (minimum, medium, maximum) are operational indicators directly observed in students' behaviour and at the level of results and products of a particular activity.

Table 1. *Levels of results assessment in the context of the criteria-based assessment of knowledge of primary school students.*

Indicators	Descriptors	Achievement level	Quality indexes
Stable forming, able to self-development	• right • complete • consistent • undoubtedly	Independently	Excellent
Requires training for knowledge consolidation	•with few mistakes •insufficiently complete •partly consistent •with slight fluctuation, overcome under the teacher's direction (guiding questions)	Under teacher's direction	good
In the process of development	• with mistakes • incomplete • inconsistent • with fluctuations, overcome with ongoing support (clarification, instruction)	with ongoing support	satisfactory

CONCLUSION

From the foregoing it follows that spatial representation is a specific kind of mental activity aimed at solving problems that require orientation in practical and theoretical space (both visible and imaginary). In its most advanced forms, this is the operation of generalized images and relationships, both between them and between elements within them, in which spatial properties and relationships are recorded. Using the initial images created on a different graphical basis, the representation ensures their transformation and creation of new images that are different from the original ones; shape, size and spatial relationships; spatial images in the visible or imaginary space (on the plane). In the image, as the basic operational unit of the spatial representation, the spatial characteristics of the object (shape, size, relative position of the constituent elements, etc.) are represented in their structure; the spatial representation is a multilevel formation. The elements of different content and level of development are included there. The structure of the spatial representation depends on the content of the visual (graphic) material, the specific nature of the task, the nature, the activity of the representation (ways of creating spatial images and operating them). The structure of spatial representation is determined by the function of images in the system of cognitive (educational) activity and is characterized by the dynamism, completeness, degree of novelty of spatial images.

Considering the fact that an effective means of cognizing the space for junior schoolchildren is their own practical actions with objects, it is necessary to use the models of

cubes for each child in order to practically verify conjectures and hypotheses at performing dice exercises. At such approach to doing exercises on the location of spatial objects relatively to each other according to the 'scheme of their body' or other reference points, recognition and visualization of these objects and their projections in the drawing or picture are of sufficient value both for the formation of spatial representations and for development of spatial intelligence of younger schoolchildren.

An integral part of the education content is an objective and reliable system of assessment of students' learning achievements.

There were different ways of testing the knowledge, abilities and skills of students, the forms and methods of grading were changed, the frequency of monitoring and measuring activities and their content, measures of influence on students, motivation and many other factors in the process of the historical development of the society. For many decades, the assessment implied comparing students' achievements with the results of other students and not with their own achievements. Such assessment does not allow drawing up an individual educational course of the growth of students' learning achievements.

Different aspects of assessment are identified in psychological and pedagogical studies: essence, role, assessment functions, structure of valuation activities of the teacher and others. However, such aspects of the given problem as the development of a unified system of assessment criteria of students' educational achievements have not found conclusive determination. It is difficult to successfully realize the task of personal development without their solution.

Various forms of test measures were applied to assess students' knowledge in the traditional system, only frequency, content and forms of their conduction, grading methods, measures of influence on the students, motivational elements were changed. The attitude towards knowledge has changed in the course of time.

It is necessary to pay attention to the work on the formation of functional literacy as a necessary skill in using knowledge and skills to solve a wide range of life problems in various spheres of human activity, as well as in interpersonal communication and social relations in teaching mathematics today.

The modern comprehension of the teaching process is based on the fact that the students are fully responsible for their own education and no one will exonerate them from responsibility. Therefore, assessment of learning process should involve students, i.e., provide them with information on how well they act, and guide their follow-up efforts. Considerable part of information they receive through feedback from the teachers, the other part is directly involved in assessing their own work. The awareness of the learning process and the ability of students to manage it independently become increasingly important in the context of assertive learning throughout life.

The activity system of schoolchildren in assimilating knowledge and skills inhibits the development of the children's intellect, including spatial representations. With such system of teaching, children get used to solving problems that always have ready solutions and, as a rule, there is only one solution. In addition, children get used to solving problems basing on the already learned rules, so they are not able to act independently to find some new ways. As the survey of the literature on this subject shows, this situation does not contribute to having the spatial representations and spatial imagination as one of the main criteria for the student's education in the field of mathematics; therefore, the task of forming and developing spatial representations of junior schoolchildren continues to be one of the most important tasks of the primary school.

Thus, the criteria-based assessment means an assessment process, based on the comparison of student learning achievements with clearly defined, collectively developed criteria known to all participants in the educational process, corresponding with goals and content of education, contributing to the formation of educational-cognitive competence of the students.

REFERENCES

Ananiev, B. G. (1977). *About the problems of modern human study*. Moscow: Nauka.

Andryushina, T. V. (2000). *Psychological conditions of person's spatial intelligence development in graphic activity*. Novosibirsk: Izdatelstvo SGUPS, 148.

Arginskaya, I. I. (2009). *Mathematics problem book for individual works and tests in primary school*. Samara: Uchebnaya literatura.

Beloshistaya, A. V. (1999). *Development of spatial representations and spatial intelligence of younger schoolchildren*. Moscow: Linka-Press.

Bruner, J. (1962). *The learning process* (A. R. Luria ed.). Moscow: APN RSFSR.

Criterial system for assessing students' academic achievements in Nazarbayev Intellectual schools. JSC Nazarbayev Intellectual Schools 'Branch' Nazarbayev Intellectual School of Physics and Mathematics direction in Semey, Teachers: Chkambayeva D. A., Gabdullina D. S. Krasilnikova L. G., 2013.

Galkina, O. I. (1961). *Development of spatial representations in children in primary school*. Moscow: APN RSFSR.

Gurova, L. L. (1961). Interrelation of sensory and logical components during the solution of spatial task. In B. G. Ananiev & B. F. Lomov (Eds.) *Problems of spatial and time perception*. Leningrad: LGU.

International studies PISA. (2010). *National report on the results of an international study of PISA-2009 in Kazakhstan.* Retrieved from: http://www.naric.kz/index-49.php.htm.

Istomina, N. B. (2001). *Methods of teaching mathematics in primary classes*. Moscow: Academy.

Kabanova-Meller, E. N. (1968). *Forming the patterns of intellectual functioning and intellectual development of students*. Moscow: Prosveshchenie, 288.

Kaplunovich, I. Y. (1996). *Development of spatial intelligence of schoolchildren during the mathematics learning*. Novgorod: NRTsRO.

Kochetkova, G. G. (1996). Development of spatial intelligence of junior schoolchildren. *Elementary School, 12.*

Kosov, B. B. (1997). *Creative thinking, perception and personality*. Moscow: Voronezh.

Leontiev, A. N. (1972). *Problems of mental development*. Moscow: Izdatelstvo Moskovskogo universiteta.

Madiyarov, N., Yessaliyev, A. A., & Totikova, G. A. (2017). Psychological-physiological foundations for formation of spatial representations of younger schoolchildren at the teaching mathematics. *Proceedings of VIII International Scientific Conference 'Mathematics. Education. Culture' dedicated to the 240 anniversary of the birth of Carl Friedrich Gauss* (pp. 257-261). Togliatti.

Mozhayeva, O. I., Shilibekova, A. S., & Ziedenova, D. B. (2016). *The instruction on the criteria-based assessment for primary school teachers: Teaching aid.* 'Nazarbayev intellectual schools'. DBBI. Astana.

Moro M. I., A. S. Pchelko, A. M. Pyshkalo and others (1977). *Current problems of teaching methods of mathematics in primary school*. Moscow: Pedagogika.

Moro M. I., Volkova S. I., Stepanova S.V. et al. (2014). *Mathematics, textbooks for 1-4 grades*. Moscow: Prosveshchenie.

On the peculiarities of teaching the fundamentals of sciences in general education organizations (including inclusive education) in the Republic of Kazakhstan in 2014-2015 academic year. Instructive-methodical letter. (2014). Astana: The National Academy of Education named after Y. Altynsarin.

On the implementation of the National Action Plan for the development of functional literacy of schoolchildren for 2012-2016. The session of the Government of the RK dated September 11, 2012. Retrieved from: http://ru.government.kz.

Pavlov, I. P. (1951-1954). *Complete works* (2nd ed.). Moscow: AN SSSR.

Pchelko, A. S., Bantova, M. S., Moro, M. I, & Pyshkalo, A. M. (1991). *Mathematics for 3 grade* (18th ed.). Moscow: Prosveshchenie, 201.

Peterson, L. G. (2012). *Mathematics for 2 grade*. Part 3. Moscow: Yuventa.

Ponomarenko, Y. V., Kenzhebekova, R. I., Yessaliyev, A. A., Moldabek, K., Dairbekov, S. S., & Jumagulova, G. (2016). Pedagogical Research Methods of Training in Higher Educational Establishments: A Comparative Analysis. *IEJME: mathematics education, 11(9),* 3221-3232.

Ponomarenko, Y. V., Yessaliyev, A. A., Kenzhebekova, R. I. Dairbekov, S. S., Asambaeva, L. (2016), Students' environmental competence formation as a pedagogical problem. *International Journal of Environmental and Science Education, 11(18)*, 11735-11750.

Ponomarenko, Y. V., Zholdasbekova, B. A., Balabekov, A. T., Yessaliyev, A. A., Larchenkova, L. A. (2016). Modern methodology and techniques aimed at developing the environmentally responsible personality. *International Journal of Environmental and Science Education, 11, (9)*, 2877-2885.

Pyshkalo, A. M. (1973). *Methods of teaching of geometry elements in primary school*. Moscow: Prosveshchenie, 208.
Rubenstein, S. L. (1998). *Basic concepts of psychology*. S. Petersburg: Piter.
Sadler, D. R. (1989). Formative assessment and the design of instructional systems. *Instructional Science, 18*, 119-144.
Sechenov, I. M. (2001). *Elements of thought*. S. Petersburg: Piter.
Shekhter, M. S. (1981). *Visual recognition. Characteristics and mechanisms*. Moscow: Pedagogika, 263.
Stoletnev, V. S. (1979). Handling of spatial images during problem solution. *New studies in psychology, 1.*
The system of criteria-based assessment of students' learning achievements. (2013). Teacher edition. Astana: The National Academy of Education named after Y. Altynsarin.
Usova, A. P., & Zaporozhets, A. V. (1965). Pedagogics and psychology of sensory development and education of pre-school child. In A. P. Usova & N. P. Sakulina (Eds.) *Theory and practice of sensory education*. Moscow: Prosveshchenie.
Vekker, L. M. (1998). *Psyche and reality: single theory of mental processes*. Moscow: Smysl, 685.
Walvoord, B. E. & Anderson, V. J. (1998). *Effective grading: a tool for learning and assessment*. San Francisco, CA: Jossey-Bass.
Yakimanskaya, I. S. (1989). *Development of spatial intelligence in students*. Moscow: Prosveshchenie.
Yakimanskaya, I. S. (1990). *The method of teaching elements of geometry in primary school.* Moscow: Prosveshchenie.
Zankov, L. V. (1999). *About primary education*. Moscow: Dom pedagogiki.
Zinchenko, V. P. (2002). *Psychological basis of pedagogics*. Moscow: Gardariki.